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JC490 U.S. PTO

PATENT  
Attorney Docket No. Cao-21

Box Patent Application  
Assistant Commissioner for Patents  
Washington, DC 20231

JC675 U.S. PTO  
09/619827  
07/20/00

NEW APPLICATION TRANSMITTAL LETTER

Sir:

Transmitted herewith for filing is the Patent Application of  
Inventor(s): Yang Cao and Antonio Zuniga  
For: APPARATUS AND METHOD FOR HYBRID TELECOMMUNICATIONS  
SWITCHING

Enclosed are the following papers required to obtain a filing date under 37  
C.F.R. §1.53(b):

- |  |   |
|--|---|
| <u>11</u> Pages of Specification             | <input checked="" type="checkbox"/> Assignment                        |
| <u>3</u> Pages of Claims                     | <input checked="" type="checkbox"/> Declaration and Power of Attorney |
| <u>1</u> Page of Abstract                    |   |
| <u>3</u> Sheets of Drawings                  | <input checked="" type="checkbox"/> Certificate of Express Mailing    |
| <input type="checkbox"/> Formal              | Express Mail Label No. <u>EJ941040613US</u>                           |
| <input checked="" type="checkbox"/> Informal |   |

FEE CALCULATION:

	NUMBER FILED		BASIC FEE ALLOWANCE		NUMBER EXTRA		RATE	
Total Claims:	19	-	20	=	<u>0</u>	X	\$18.00	= \$ 0.00
Independent Claims:	2	-	3	=	<u>0</u>	X	\$78.00	= \$ 0.00
Basic Fee:								\$690.00
TOTAL:								\$690.00


\_\_\_\_\_ A check in the amount of \$\*\*\*\* is enclosed to cover the Filing Fee.

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The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§1.16 and 1.17 that may be required by this paper or any paper filed in connection with this Patent Application, or credit any overpayment, to Deposit Account No. 12-2325.

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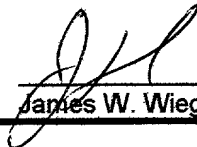
  
James W. Wiegand

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I hereby certify that this correspondence is being deposited on July 20, 2000, with the United States Postal Service as Express Mail in an envelope addressed to:

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James W. Wiegand

**PATENT**

Docket No. Cao 2 1

Inventors: Yang Cao and Antonio Zuniga

**APPARATUS AND METHOD FOR HYBRID TELECOMMUNICATIONS SWITCHING**

[illegible][illegible][illegible][illegible][illegible][illegible]

Not only has switching technology undergone major changes, the type of traffic being carried on telephone lines has also changed dramatically. Although originally designed for voice traffic and "tuned" to operation in the voice band between approximately 350 and 4000 Hz, the telecommunications infrastructure also carries data, through the use of various channels, or tones. However, with the growing use of the Internet, and the potential development such high bandwidth applications such as interactive distance-learning and video on demand, the existing telecommunications infrastructure is in danger of being overwhelmed. A large portion of the system's transmission medium has been replaced with high speed trunks which employ fiber optic transmission media, microwave media, and line of sight optical media, for example, to meet the ever mounting demand for high speed data transmission capability. Data traffic is increasing at a rate of approximately 300% per year, while voice traffic is only increasing at the relatively slow rate of approximately 5% per year. However, a huge installed base of transmission media, switching devices, and other telecommunications infrastructure provide the telecommunications path for the vast majority of telecommunications providers and users.

A system and method that enable the efficient combination and management of circuit-switched and packet-switched facilities, thereby taking advantage of the tremendous installed base of equipment and facilities while, at the same time permitting an extensive upgrade of data facilities, which, typically employ packet switching systems would therefore be highly desirable.

#### **RELATED APPLICATIONS**

Patent Applications entitled, "Apparatus and Method For Synchronous and Asynchronous Switching of Internet Protocol Traffic", and "Apparatus and Method For Synchronous and Asynchronous Switching of ATM Traffic", filed on the same day as this application and assigned to the same assignees as this application is assigned are hereby incorporated by reference.

Variable	Mean	SD	Min	Max
Age	34.5	10.2	21	55
Gender	Male	Female		
Marital Status	Married	Single		
Education	High School	College		
Occupation	Manager	Worker		
Income	\$10,000	\$20,000		
Health Status	Good	Fair		
Exercise Frequency	Weekly	Monthly		
Stress Level	Low	High		
Sleep Quality	Good	Poor		
Dietary Habits	Healthy	Unhealthy		
Alcohol Consumption	None	Occasional		
Tobacco Use	Non-smoker	Smoker		
Family Size	2	3		
Work Hours	40	50		
Commuting Time	30	45		
Home Ownership	Renter	Owner		
Neighborhood Safety	Safe	Unsafe		
Access to Healthcare	Yes	No		
Health Insurance	Private	Public		
Medical History	None	Chronic		
Genetic Predisposition	Low	High		
Environmental Factors	Clean	Polluted		
Social Support	Strong	Weak		
Life Satisfaction	High	Low		
Overall Health Score	75	15	50	100

Variable	Mean	SD	Min	Max
Age	34.5	10.2	21	55
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Tobacco Use	Non-smoker	Smoker		
Family Size	2	3		
Work Hours	40	50		
Commuting Time	30	45		
Home Ownership	Renter	Owner		
Neighborhood Safety	Safe	Unsafe		
Access to Healthcare	Yes	No		
Health Insurance	Private	Public		
Medical History	None	Chronic		
Genetic Predisposition	Low	High		
Environmental Factors	Clean	Polluted		
Social Support	Strong	Weak		
Life Satisfaction	High	Low		
Overall Health Score	75	15	50	100

Variable	Mean	SD	Min	Max
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Environmental Factors	Clean	Polluted		
Social Support	Strong	Weak		
Life Satisfaction	High	Low		
Overall Health Score	75	15	50	100

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The above and further features, aspects, and advantages of the invention will be apparent to those skilled in the art from the following detailed description, taken together with the accompanying drawings in which:

Figure 1 is a conceptual block diagram which illustrates a network of hybrid switches in accordance with the principles of the present invention;

Figure 2 is a conceptual block diagram of a hybrid telecommunications switch in accordance with the principles of the present invention; and

Figure 3 is a flow chart depicting the operation of a hybrid telecommunications switch in accordance with the principles of the present invention.

## **DETAILED DESCRIPTION**

A hybrid telecommunications switch in accordance with the principles of the present invention includes both circuit switching and packet switching facilities and a management system and method for allocating traffic among the switching facilities. The circuit switching facilities may employ a Synchronous Transport Signal (STS) crossconnect with interfaces to SONET rings, for example, and the packet switching facility may use an ATM switch fabric for switching traffic in the form of ATM and/or IP packets or cells. In one aspect of the invention, traffic for which circuit switching may be more appropriate may be separated from traffic that is more suitably handled by packet switching facilities. That is, for example, real-time traffic, such as voice traffic, may be more appropriately handled by a circuit switching facility, and non-real-time traffic, such as Internet email traffic, may be more suitably handled by a packet switching facility. After separation, the real-time traffic may be switched through an STM switch fabric and the non-real time traffic, which may be ATM or IP traffic, may be switched through a packet switch fabric.



254, and 256. An I/O interface, such as I/O interface 234 may provide a connection to another network element, or node, through a link such as the link 102 which connects nodes A and B of Figure 1. Traffic arriving at one of the I/O interfaces is routed under control the hybrid resource manager 202 by a shelf controller which more directly controls the operation of a local STM switch. Each of the local STM switches may be, for example, an STS-1 level cross-connect, with the capacity of the cross-connect dependent upon the I/O capacity of the corresponding I/O interface. That traffic which is routed to the central packet switch fabric 232 may be directed through a switch interface, such as SWIF 250, embodied as an advanced "UTOPIA" interface which is capable of transferring both ATM cells and packet-based traffic.

As described in greater detail in the discussion related to Figure 2, the hybrid resource manager partitions incoming traffic into STM and ATM streams. The STM portion may be switched in a local STM switch, such as local STM switch 242, for example, or it may be switched through a central STM switch fabric 204. Typically, a single ring SONET/SDH embodiment would require only one STM unit, such as the unit 206, to provide an interface to the ring and to provide the STM switching function. A multi-ring or mesh connection would include a plurality of the STM units, as illustrated, and the STM switching may be provided by a central STM switch fabric 204 which could direct traffic into and out of any of the I/O interfaces and to the packet switch fabric 232, as needed. Alternatively, traffic entering one STM unit could be packetized and switched through the central packet switch fabric 232 to travel between I/O interface 234 and I/O interface 240, for example. Each of the I/O interfaces, such as I/O 234, acts as a ring, or line interface. The hybrid resource manager 202 communicates with the next node in a path of which it is a part and determines, "on the fly", which switch fabric, such as a local STM 242, central packet 232, or central circuit 204 will be employed to switch traffic associated with a particular path overhead indicator.

For each inter-connecting link, such as link 102 between nodes A and B, the total bandwidth of the link is partitioned into a plurality of units and these units are allocated to STM, IP, and/or ATM traffic. If the packet switch fabric 232 supports a UTOPIA-II interface, the basic unit is an STS-1. If the switch fabric 232 supports a UTOPIA-III interface, the unit

is an STS-3C. For example, if the link 102 is an OC192 link, and the switch fabric supports UTOPIA-III, the link is partitioned into 64 OC-3C based unit. For each unit, there is one entry in an ingress and egress resource table, as follows:

Ingress Resource Table:

Tributary No.	Free Flag	Destination Address	Available Bandwidth	Status: Drop / Pass

Egress Resource Table:

Tributary No.	Free Flag	Destination Address	Available Bandwidth	Status: Add / Pass

The destination Address is either based on the IP address for the node or a proprietary address. For each ingress link, there is one ingress resource table associated with it. Correspondingly, there is one egress resource table for each egress link. It is assumed that there is at least one entry in each link's resource table.

At initialization time, all the free flags are initialized to have the value 0, indicating that the link is free. The available Bandwidth interest takes the initial value of the link's total physical transmission bandwidth, the Destination Address is initialized as 0, and Status is initialized as either Add (egress link) or Drop (ingress link).

In accordance with the principles of the invention, a SONET/SDH path layer overhead byte is employed to indicate to a shelf controller such as shelf controller 226, which type of switch fabric, for example, STM or ATM, should be employed to switch the traffic associated with the SONET/SDH path layer overhead byte. This determination is made by the shelf controller, as instructed by the hybrid resource manager 202, as the traffic arrives







## CLAIMS

1. A hybrid telecommunications switch apparatus comprising:  
one or more circuit switch fabrics,  
one or more packet switch fabrics,  
a controller configured to route telecommunications traffic to one or the other of the said circuit or packet switch fabrics.
2. The apparatus of claim 1 wherein the controller is further configured to examine traffic overhead information to determine which of said switch fabric types to route the traffic to.
3. The apparatus of claim 2 wherein the overhead information is a SONET/SDH path overhead byte.
4. The apparatus of claim 3 wherein the overhead byte is a C2 overhead byte.
5. The apparatus of claim 1 wherein the circuit switch fabric is a synchronous transport signal (STS) crossconnect.
6. The apparatus of claim 1 wherein the packet switch fabric is configured to switch internet protocol (IP) or asynchronous transfer mode (ATM) traffic.
7. The apparatus of claim 1 further comprising a plurality of circuit switch fabrics.
8. The apparatus of claim 1 wherein the controller is configured to examine a path overhead byte associated with received traffic and to thereby determine whether the traffic is ATM, IP, or STM traffic.

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9. The apparatus of claim 8 wherein the controller is configured to dynamically allocate circuit switch resources to ATM traffic to route the traffic to a packet switch fabric for switching.
  10. The apparatus of claim 9 wherein the controller is configured to dynamically allocate circuit switch resources to IP traffic to route the traffic to a packet switch fabric for switching.
  11. A method of switching telecommunications traffic in a hybrid switch including an (circuit) switch fabric, an packet switch fabric, and a controller, the method comprising the steps of:
    - (A) provisioning the circuit switch fabric for IP, ATM, and circuit traffic,
    - (B) determining whether received traffic is IP, ATM, or circuit traffic, and
    - (C) switching the received traffic in an packet or circuit switch fabric in response to the determination of step (B).
  12. The method of claim 11 wherein the determining step (B) comprises the step of:
    - (B1) the controller examining traffic overhead information to determine which of said types of traffic has been received.
  13. The method of claim 12 wherein the step (B1) comprises the step of:
    - (B2) the controller examining an SONET/SDH path overhead byte.
  14. The method of claim 13 wherein the overhead byte is a C2 overhead byte.
  15. The method of claim 14 wherein the step (C) of switching comprises the step of:
    - (C1) the controller directing ATM traffic to a packet switch fabric.

16. The method of claim 14 wherein the step (C) of switching comprises the step of:  
(C2) the controller directing IP traffic to a packet switch fabric.
17. The method of claim 14 wherein the step (C) of switching comprises the step of:  
(C3) the controller directing traffic that is neither ATM or IP traffic to the circuit switch fabric.
18. The method of claim 14 wherein the step (C) of switching comprises the step of:  
(C4) the controller dynamically allocating circuit switch resources to ATM traffic to route the traffic to a packet switch fabric for switching.
19. The method of claim 14 wherein the step (C) of switching comprises the step of:  
(C5) the controller dynamically allocate circuit switch resources to IP traffic to route the traffic to a packet switch fabric for switching.

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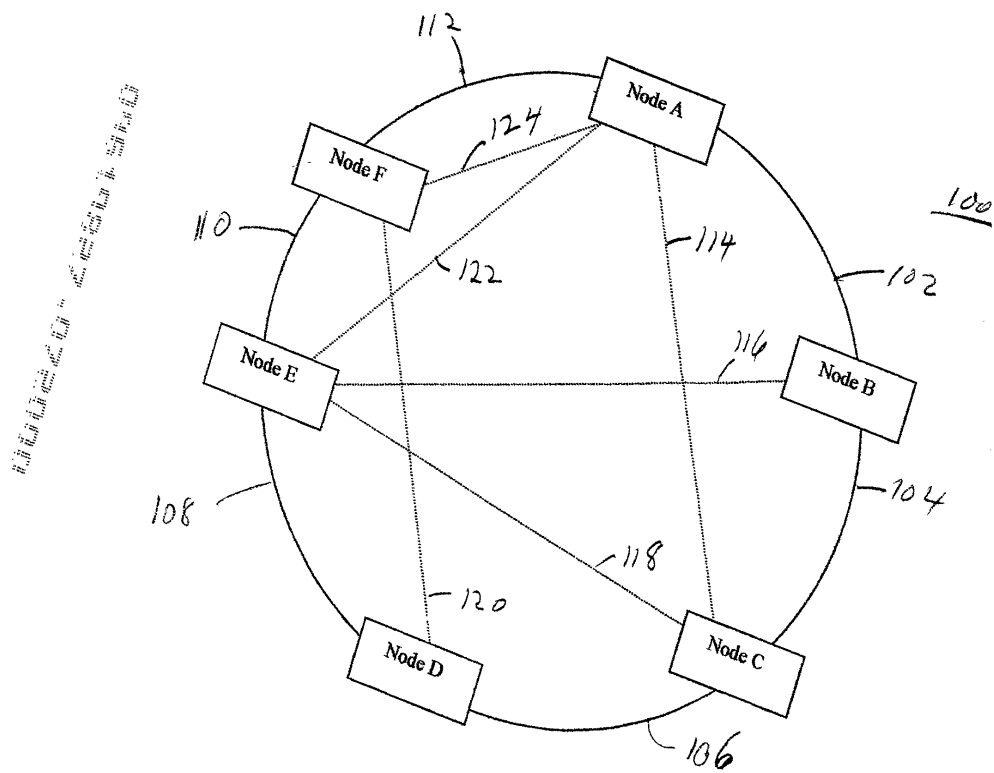


FIGURE 1

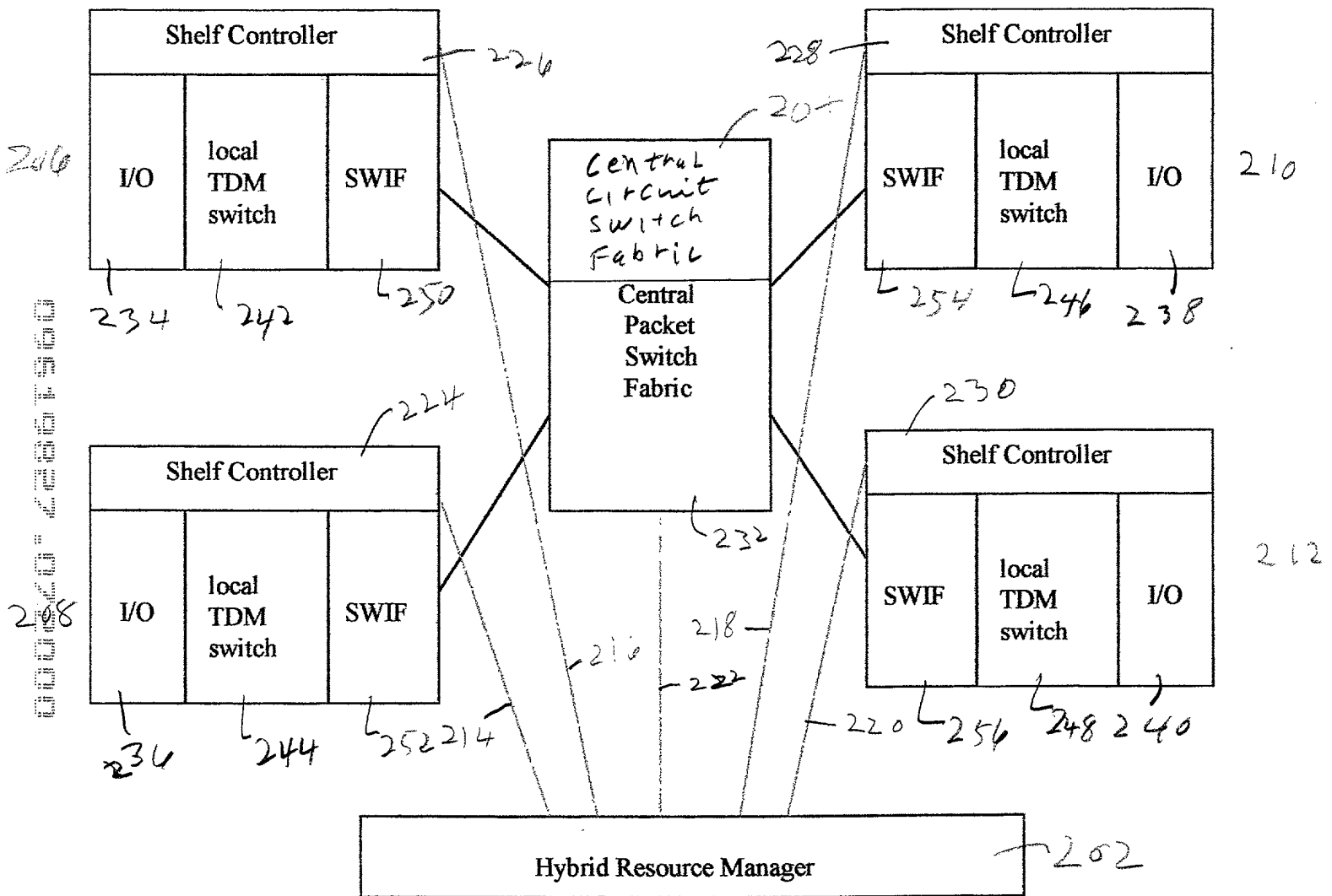


FIGURE 2

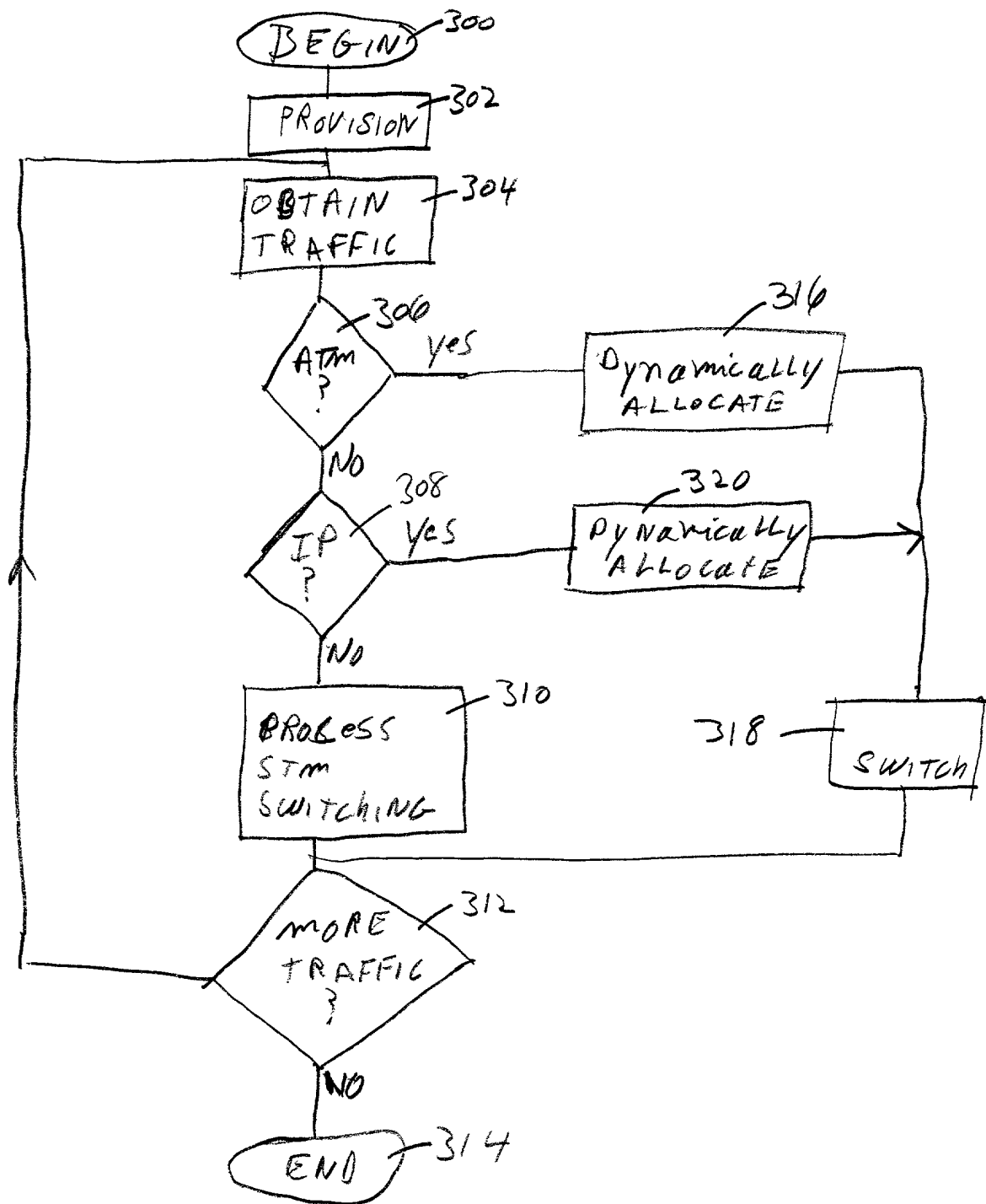


FIGURE 3

## Declaration and Power of Attorney

My residence, post office address and citizenship are as stated below next to my name.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney with full power of substitution and revocation, to prosecute said application, to make alterations and amendments

Country	Year	GDP (constant 2005 prices)		GDP per capita (constant 2005 prices)		Population (millions)		Urban population (millions)		Rural population (millions)		Total population (millions)	
		2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Algeria	2005	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2006	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2007	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2008	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2009	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2010	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2011	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2012	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2013	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2014	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2015	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2016	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2017	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2018	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2019	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2020	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2021	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2022	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2023	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2024	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2025	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2026	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2027	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2028	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2029	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2030	10,000	10,000	1,000	1,000	2.5	2.5	1.5	1.5	1.0	1.0	3.5	3.5
Algeria	2031	10,000	10,000	1,000	1,000	2.5	2.5						

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David Volejnicek	(Reg. No. 29355)
Charles L. Warren	(Reg. No. 27407)
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Full name of 2nd joint inventor: Antonio Zuniga

Inventor's  
signature

*A Zuniga*

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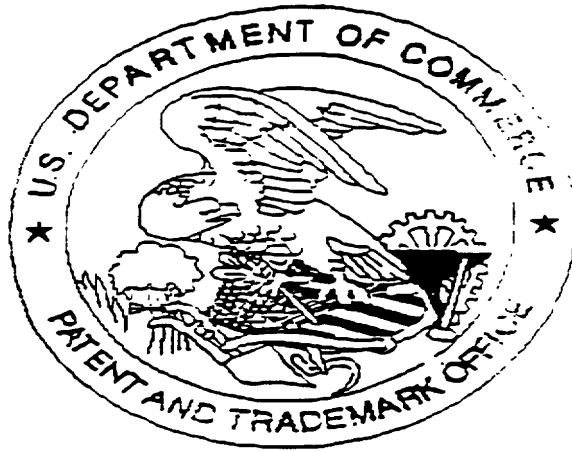
Post Office Address: 6734 Vanderbilt Street  
Houston, TX 77005

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Variable	Mean		SD		t		p	
	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention
Age	20.5	20.5	1.2	1.2	0.0	0.0	0.999	0.999
Gender	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Education	12.5	12.5	1.0	1.0	0.0	0.0	0.999	0.999
Marital status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Religion	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental parental parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental parental parental parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental health status	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental family size	4.0	4.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental parental education	10.0	10.0	1.0	1.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental parental occupation	50%	50%	0.0	0.0	0.0	0.0	0.999	0.999
Parental parental parental parental parental parental parental income	10.0	10.0	2.0	2.0	0.0	0.0	0.999	0.999

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